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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
08/988,686	12/11/1997	ANTHONY J. KONECNI	TI-22166	7837

23494 7590 02/19/2002

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EXAMINER

WILCZEWSKI, MARY A

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 02/19/2002

#24

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

08/988,686

Applicant(s)

Konecni et al.

Examiner

Mary Wilczewski

Art Unit

2822



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE THREE (3) MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on May 22, 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 16-32 is/are pending in the application.
- 4a) Of the above, claim(s) 16-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- *See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892) 18) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 19) ☐ Notice of Informal Patent Application (PTO-152)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 20) ☐ Other: _____

Art Unit: 2822

DETAILED ACTION

In view of the Appeal Brief filed on May 22, 2001, PROSECUTION IS HEREBY REOPENED. New grounds of rejection are set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

- (a) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,
- (b) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

Claim Rejections - 35 USC § 112

Claims 21-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 21 recites the limitation "said insulating structure" in line 6. There is insufficient antecedent basis for this limitation in the claim.

Claim 21 recites the limitation "said first conductive layer" in line 9. There is insufficient antecedent basis for this limitation in the claim.

Art Unit: 2822

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 21-26, 29, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masanori, JP4-171744, in view of Takeyasu et al., the article entitled "Characterization of Direct-Contact Via Plug Formed by Using Selective Aluminum Chemical Vapor Deposition".

Masanori discloses a method of fabricating an electronic device comprising the steps of forming a first electrically conductive structure comprising aluminum 3; forming an insulating layer 4 extending above the first electrically conductive structure, the insulating layer having an opening with sidewalls and a bottom exposing a portion of the first electrically conductive structure; providing a gas comprising argon and hydrogen incorporated within a plasma into the opening to remove a denatured layer formed on the first electrically conductive structure; then depositing a conductive material comprising aluminum 5 into the opening.

Masanori does not disclose that the conductive material deposited into the contact opening is deposited by Chemical Vapor Deposition (CVD). However, Takeyasu et al. disclose a method of forming multi-layered interconnections having both the lower and upper

Art Unit: 2822

conductive layers comprising aluminum wherein an aluminum plug is formed in the contact hole by selective CVD after a cleaning step is performed, see the abstract and Fig. 1(b). The method of Takeyasu et al. is low cost and yields a high performance interconnection with low via resistance, therefore, it would have been obvious to one skilled in the art that the Al/Al direct-contact via structure of Takeyasu et al. could have been substituted for the upper aluminum layer of Masanori. The via structure of Takeyasu et al. also ensures complete filling of the via.

Masanori et al. disclose that other rare gasses can be used in place of argon. Therefore, it would have been obvious to one skilled in the art to use helium in the known method of Masanori et al.

The plasma power of about 150 watts to about 450 watts is a processing parameter which would have been obvious to optimize. The power at which a plasma is generated from is a well known processing variable and the discovery of the optimum or workable plasma power range involves only routine skill in the art. Furthermore, the specification contains no disclosure of either the critical nature of the claimed plasma power or any unexpected results arising therefrom. In any case, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose the particular claimed range of powers because applicant has not disclosed that these plasma powers are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using other

Art Unit: 2822

powers. Indeed, it has been held that optimization of range limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

Claims 27, 28, 31, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masanori, JP4-171744, in view of Takeyasu et al., the article entitled "Characterization of Direct-Contact Via Plug Formed by Using Selective Aluminum Chemical Vapor Deposition", as applied to claim 21 above, and further in view of Pan et al., U. S. Patent 6,008,139.

Masanori et al and Takeyasu et al. are applied as above. Masanori et al. fail to disclose that the plasma has a bias power up to about 300 watts.

Pan et al. teach that a bias power of from about 20 to about 1000 watts is applied to a plasma used to etch a material in order to provide a more anisotropic and directional etch perpendicular to the surface of the substrate (column 6, lines 16-30). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a bias to the plasma of Masanori et al. since, as taught by Pan et al., a biased etching plasma would provide a more anisotropic and directional etch perpendicular to the surface of the substrate thereby increasing the effectiveness at which the plasm gas is delivered to the surface of the conductive material at the bottom of the contact hole in the known method of Masanori et al. Furthermore, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose the particular bias power recited in claims 27 and 28 because applicant has not disclosed that this

Art Unit: 2822

bias power is for a particular unobvious purpose, produces an unexpected result, or is otherwise critical, and it appears prima facie that the process would possess utility using another bias power. Indeed, it has been held that optimization of range limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

Response to Arguments

Applicant's arguments filed May 22, 2001 have been fully considered but they are not persuasive. Applicants argued in the Appeal Brief that the use of a hydrogen plasma chemistry is not taught by Masanori. However, the English-language abstract clearly teaches the dry etching of an aluminum layer using an argon-hydrogen mixture to remove a denatured layer (shown as layer 6 in Figure 2). The plasma does not contain a halogen, however, HF and H₂O are products of the chemical reaction of the hydrogen with fluorine and oxygen in the denatured layer. The claim, as presently drafted, merely requires the gas used in the process to be halogen-free; the claim does not preclude the formation of halogen-containing products as a result of the chemical reaction.

Art Unit: 2822

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additionally cited patents disclose the use of a cleaning step in the formation of multi-level interconnects.

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to M. Wilczewski whose telephone number is (703)308-2771.



M. Wilczewski
Primary Examiner
Tech Center 2800

MW

February 11, 2002